



Newsletter

Volume 3, Number 5
September - October 1986

This fall at the Arboretum

Take a self-guided tour of the Wappinger Creek Trail, enjoying the fall foliage.

Take a course, or courses, in our Adult Education Program. Registration for late fall courses continues into November.

Attend our Sunday Ecology Programs on the first and third Sunday of each month.

See the Fall Calendar on the last page of this Newsletter for information on all our current public programs.

The IES Newsletter is published by the Institute of Ecosystem Studies at the Mary Flagler Cary Arboretum. Located in Millbrook, New York, the Institute is a division of The New York Botanical Garden. All newsletter correspondence should be addressed to the Editor.

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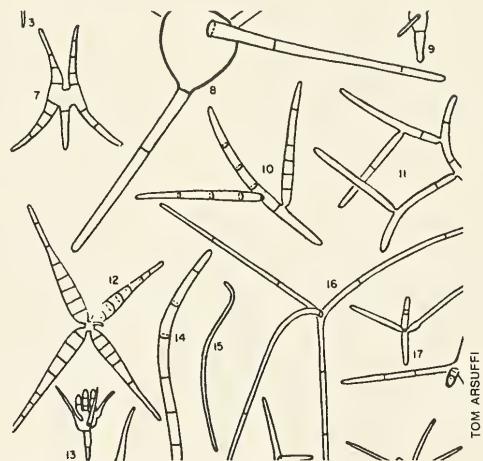
Summer Research on Stream Communities, Urban Forests and Butterfly Memory

The summer of 1986 brought three visiting scientists to the Institute of Ecosystem Studies — scientists who are established at other research and educational institutions but who wanted the opportunity to collaborate with IES ecologists and do field work at our facility. Two of these scientists, Dr. Thomas L. Arsuifi and Dr. Carleton S. White, came as Cary Summer Research Fellows while the third, Dr. Alcinda C. Lewis, was supported by a grant from the National Science Foundation.

The Cary Summer Fellowship is an annual award enabling one or more scientists to do research at the Institute. Funds for the award are provided by the Mary Flagler Cary Charitable Trust. Cary Fellows are typically at an early stage in their scientific careers, and the research position at the Institute gives them the opportunity to pursue intensive, uninterrupted research. Results from these short-term projects at IES contribute to the scientists' long-term teaching and research programs at their home institutions.

DR. THOMAS ARSUIFI is a College Assistant Professor in the Biology Department at New Mexico State University. His research there involves fungal and invertebrate interactions on decaying leaves in streams. Certain species of fungi dominate the decay process in running waters. They are characterized by morphologically unique spores — "S" shaped or tetraradiate (with four arms) — which aid in colonization. The fungi contribute to the initial breakdown of leaves that fall into streams. The partially decayed leaf matter is more digestible to insects, which lack the necessary enzymes to break down leaf structures. It is also more nutritious due to the nitrogen and protein content of the fungi themselves. Dr. Arsuifi is working to answer the questions: Do fungi grow better on different leaf types? Are there differences among fungi as a source of food for detritivores (organisms which feed on detritus)?

As a Cary Fellow, Dr. Arsuifi collaborated with IES Aquatic Ecologist Dr. Stuart Findlay to get a whole-community perspective on the leaf decay process. Dr. Arsuifi worked on fungal activity while Dr. Findlay concentrated on bacterial breakdown, using sycamore leaves collected from the East Branch of Wappinger Creek. The leaves were taken to the lab where fungal spores were collected, the hyphae (thread-like structures which make up the fungal body) measured, and bacterial numbers estimated. Dissolved organic carbon and



Conidia, or spores, of aquatic fungi are morphologically unique.

fine particulate material released as a result of the microbial activity during leaf breakdown, plus any fungal spores produced, can serve as food and nutrients for other organisms downstream.

DR. CARLETON WHITE is a research associate at the University of New Mexico, who spent ten weeks as a Cary Fellow acquiring data on nitrogen cycling in an urban forest ecosystem. His field work, in collaboration with IES Terrestrial Ecologist Dr. Mark McDonnell, focused on The New York Botanical Garden Forest in the Bronx, one of the last remnants of the original forest which once covered the New York City area. The goal of his study was to gain insight into the effect the urban environment has on the cycling of nitrogen in the forest ecosystem.

The nitrogen cycle is one of the biogeochemical cycles in which nutrients essential for life are circulated within an ecosystem. The nitrogen cycle is dependent upon microbes which break down organic matter, for example dead animals and plants, and convert the by-products to atmospheric nitrogen or to the inorganic nitrogen compounds vital in plant nutrition. By measuring nitrogen mineralization potentials, or, more simply, the highest possible rate that microbes can convert organic nitrogen to mineral forms, relative measures of nutrient availability can be determined.

Dr. White collected soil samples from nearly pure stands of eastern hemlock in the Bronx and at the Arboretum, and processed the samples at the IES labs. Although nitrogen mineralization potentials typically vary from spot to spot within a forest, he found that all Bronx samples were remarkably similar. In his

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final report, Dr. White writes: "This suggests that another factor is controlling nitrogen mineralization processes in the Bronx rather than the expected factors of soil type and litter quality. This could be the result of high levels of heavy metals, or the result of 'urban grime' coating the particle surfaces and restricting the available surface area for microbial activity." Drs. White and McDonnell will be actively pursuing the subject of urban grime in future collaborative research.

DR. ALCINDA LEWIS spent her third summer at IES, having come first as a Cary Summer Fellow in 1984. A research associate at the University of Boulder in Colorado, she returns to IES because of the abundant wildflowers and butterflies in this area, and because of the Institute's excellent greenhouse facilities where she can make her observations of butterfly learning behavior under carefully controlled conditions.

Dr. Lewis became interested in the behavior of a species of cabbage butterfly, *Pieris brassicae*, when she was doing postdoctoral work in London at the greenhouses of Miriam Rothschild, a pioneer in the field of chemical ecology. Her current research deals with learning in *Pieris rapae*, another cabbage butterfly (see following article), which she raises in small enclosures in the IES greenhouse, feeding them favored species of wildflowers. By holding the butterflies by their "shoulders," she marks the wings harmlessly with an indelible pen so that the insects can be readily identified during the course of her experiments.

She observed that a butterfly which feeds first on one flower continues to feed on that species regardless of other, equally appealing blossoms in the vicinity. She also noted that the insect becomes more adept at finding its way to the sweet nectar within the flower of that one species, reducing the search time from ten seconds to two or three after only three tries. She

then found that when butterflies were moved to another cage, away from their preferred flower type, they became proficient at locating nectar in the new flowers and in the meantime forgot what they had learned about the first ones.

In a recent paper on her 1985 IES research¹, Dr. Lewis wrote how, one hundred and ten years ago, Charles Darwin hypothesized that nectar-feeding insects showed flower constancy because they had learned how to reach the nectar quickly. Dr. Lewis has confirmed this behavior in butterflies, and has concluded that the advantages for the insects include making the best use of their two-week lifespan, and reducing predation by spending less time at any one flower.

1. *Science*: 16 May 1986, Volume 232, pp. 863-865

The Natural History of a Research Subject

When the subjects of Dr. Alcinda Lewis' behavioral studies are dancing over a field in search of their favored wildflowers, it is difficult to picture these insects as serious plant pests. In fact, these European cabbage butterflies are not the direct cause of the damage done to plants of the cabbage family: it is the caterpillar, or larval, stage in the insect's life cycle that is such a voracious eater.

The North American relationship with the small white butterflies began in 1860 when they were introduced accidentally to Quebec from Europe. Within 20 years they were known everywhere east of the Mississippi and now are present across the continent. (The global spread continued, and they reached New Zealand in 1930 and Australia in 1939.) The European cabbage butterfly, *Pieris rapae* Linnaeus, is a member of one of the major, world-wide families — Pieridae — which includes all whites, sulphurs and orange tips. A common behavioral trait is that adults of most species favor open, sunny places where they visit flowers and drink at mud puddles. *P. rapae* is not unlike its cousins in this respect, but increasingly it also can be seen in small forest clearings.

Pieris rapae adults have yellowish-white wings with a dark gray tip on the fore wings. The female's fore wings have

two small black spots while the male's have just one, and both sexes have one black spot on the front margin of the hind wings. The caterpillar, smooth and green, is known in some gardening texts as the 'imported cabbageworm'.



It is particularly fond of many garden crops including cabbage, cauliflower, mustard, Brussels sprouts and lettuce, as well as some flowers — especially nasturtiums, which contain the same essential oil as cabbage — and weeds.

The overwintering stage in the insect's life cycle is the pupa; the chrysalis is a plain gray, green or tan with angular projections, and is suspended from a leaf, twig or even a building by a belt of silk. In late March the adult butterflies emerge from the chrysalis and females are soon laying yellow, bullet-shaped eggs on the underside of leaves. Within a week the caterpillars have emerged and are eating large holes in leaves. These caterpillars are full-grown when they reach an inch in length at which time they pupate. Adults emerge in about a week, and the cycle continues. At least three generations — more in warmer climates — mature each year.

While poison sprays have been used to control these crop pests in the past, such means are being phased out in favor of control by a bacterial insecticide (*Bacillus thuringiensis*) and parasitic wasps, one species of which feeds on chrysalids and another on larvae. In view of the number and adaptability of the cabbage butterfly, however, such controls should not bring an immediate end to scientific observation of these insects.

New Staff

LINDA DOWNEY, financial systems manager, will be computerizing a financial accounting system for IES and assisting with grants administration. Previously she was assistant to the executive vice president at St. Francis Hospital in Poughkeepsie, and prior to that was associate director of grant and contract administration at Yale University. Her first months at IES will be spent evaluating the staff's accounting needs and setting up a computerized system. Later her responsibilities will turn more to grant accounting, relieving the IES scientists and educators of some of the administrative tasks related to grants.



EMIL KELLER

SHARI LIFSON, graphics specialist, is assisting the scientific and education staff with their graphics and photographic work on a part-time, free-lance basis. Ms. Lifson has a bachelor of arts degree in scientific illustration from Cornell University.



SHARI LIFSON

BENJAMIN PEIERLS, research assistant I, is working with Drs. Jonathan Cole and Nina Caraco on the Hudson River study (see article below), doing field sampling and laboratory experimentation. A scuba diver, he spent the summer assisting Drs. Cole and Caraco as well as Dr. Gene E. Likens with their research at Hubbard Brook, studying nutrient fluxes in Mirror Lake. (Benjamin Peierls was not available for a photograph at press time.)

Promotions



EMIL KELLER

INES LORUSSO, research assistant II, has joined Chemical Ecologist Clive Jones in his studies of the chemistry of the cottonwood tree, and the effects of ozone on the trees' resistance to insects and pathogens. Ms. Lorusso did her undergraduate work at the University of Buenos Aires and received a master's degree in chemistry from the University of Pittsburgh.



SHARI LIFSON

PHYLLIS HAIGHT has been promoted to assistant business manager and purchasing agent at the Institute. Ms. Haight has been a member of the staff for over eight years, most recently as assistant to the Institute's business manager, Amy King. In her new position, she will be in charge of all purchases and, when the computerized accounting system is in operation, will have a more direct involvement in the payroll process.

Hudson River Foundation Grants to IES

Two IES research projects are benefiting this year from grants from the Hudson River Foundation. Dr. David L. Strayer has received \$7,738 for his continuing studies of the biology of groundwater, and Dr. Jonathan Cole and colleagues have been awarded \$70,026 for a new project on Hudson River phytoplankton.

The three-year old Hudson River Foundation is an independent, non-profit organization. Its 17-member Hudson River Panel comprises scientists, conservationists, and representatives of utility companies and government agencies, and reviews proposals submitted to the Foundation. Awards are made twice a year to scientists, educators and environmentalists doing research projects relating to the river, and 19 awards —

including the two at IES — were announced in May 1986.

This is the third grant that the Foundation has given to Dr. Strayer. The funds enable him to continue his examination of the biological communities that live in underground waters. Through regular sampling of groundwater in gravels near the East Branch of Wappinger Creek in Millbrook as well as in other areas, he and his research assistants have discovered invertebrate animal species never before recorded. This work is especially significant in that it may provide local communities with a better understanding of groundwater quality.

Dr. Cole, an aquatic microbiologist, Dr. Nina Caraco, IES biogeochemist, and Dr.

Robert Howarth of Cornell University will collaborate on a new study to measure the activity of phytoplankton (microscopic floating plants, from "phyto" = plant, and "planktos" = wandering or floating) in the tidal freshwater portion of the Hudson River from Poughkeepsie north to Albany. Phytoplankton, like other plants, use sunlight and inorganic nutrients to synthesize organic matter which forms a base of the aquatic food web. The scientists will be measuring the rates at which phytoplankton in the Hudson River synthesize this organic matter, and will investigate some of the factors that limit the rate of that synthesis. Such measurements, which are basic to the understanding of the Hudson River ecosystem, have not yet been done in its tidal freshwater areas.

HBES Meeting

In 1963 the Hubbard Brook Valley in the White Mountains of New Hampshire was selected as the site of a multidisciplinary study of air-land-water interactions. Research topics in the Hubbard Brook Ecosystem Study (HBES) include acid rain and acid cloudwater, forestry practices, soils, and stream and lake ecosystems.

On July 8th and 9th, HBES founders Dr. Gene E. Likens, Director of the Institute of Ecosystem Studies, Dr. F. Herbert Bormann (Yale University) and Dr. Robert Pierce (USDA Forest Service) convened the Hubbard Brook Ecosystem Study Annual Cooperator's Meeting. In his introductory remarks, Dr. Pierce stated that the reasons for this gathering were to find out what each scientist is doing, to present plans for future study, to stimulate the understanding of ecosystem process and function, to provide a sound basis for understanding forest landscapes and for managing forests...and to have some fun! One hundred twenty-four students, scientists and others attended the meeting. Over fifty short talks were given about ongoing work in the Hubbard Brook Experimental Forest and at Mirror Lake, workshop groups met to consider special topics ... and the traditional softball game rounded out the agenda.



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Fall Calendar

COURSES

As a part of the Institute's Adult Education Program, special crafts courses are offered. Telephone the Gifford House at the number below to register for the following:

- Large Wired Pinecone Wreath, Nov. 8 & 22
- Pounded Ash Splint Basketry, Nov. 15 & 22
- Tree and Package Ornaments, Dec. 6
- Stenciled Table Runner, Dec. 6
- Williamsburg Centerpiece, Dec. 13
- Candlestick Greenery & Kissing Ball, Dec. 13

Adult Education Program catalogues have been sent to all members and previous course participants. If you are not already on our mailing list and would like to receive a catalogue, call the Gifford House.

SUNDAY ECOLOGY PROGRAMS

Public programs are offered on the first and third Sunday of each month. All programs are from one to two hours long, and begin at 2:00p.m. at the Gifford House unless otherwise noted. They are open to everyone at no cost.

Tentative schedule (please call the number below to confirm the day's topic):

- October 5th, Monitoring the environment
(John Eaton) - W
- October 19th, Interpreting the history of New England woodlots (Charles Canham) - W
- November 2nd, The ecology of Lyme Disease
(Jay McAninch) - T
- November 16th, Reading the rocks
(Alan Berkowitz) - W
- December 7th, An Ecuadorian experience
(Jill Cadwallader) - T
- December 21st, The oceanic ecosystem
(Michael Pace) - T

W = Walk (wear clothing appropriate for weather conditions)

T = Talk (slide presentation, in the Gifford House)

For more information, call (914) 677-5359 weekdays from 8:30 - 4:30

Left: W. Breck Bowden, an HBES scientist from Yale University, described current research at Watershed 5 for first-time visitors to the Hubbard Brook Experimental Forest.

SCIENTIFIC SEMINARS

The Institute's weekly program of scientific seminars features presentations by visiting scientists or Institute staff. All seminars take place in the Plant Science Building on Fridays at 3:30 p.m. Admission is free. For a schedule, contact Julie Morgan at (914) 677-5343.

ARBORETUM HOURS

Monday through Saturday, 9 a.m. to 4 p.m.; Sunday, 1 - 4 p.m. The Gift and Plant Shops are open Tuesday through Saturday 11 a.m. to 4 p.m.; Sunday 1 - 4 p.m. Closed on public holidays. All visitors must obtain a free permit at the Gifford House for access to the Arboretum. Roads closed to vehicles when snow covered and during the deer hunting season.

MEMBERSHIP

Take out a membership in the Mary Flagler Cary Arboretum. Benefits include a special member's rate for IES courses and excursions, a 10% discount on purchases from the Gift Shop, six issues of the IES Newsletter each year, free subscription to *Garden* (the beautifully illustrated magazine for the enterprising and inquisitive gardener), and parking privileges and free admission to the Enid A. Haupt Conservatory at The New York Botanical Garden in the Bronx. Individual membership is \$25; family membership is \$35. For information on memberships, contact Janice Claiborne at (914) 677-5343.

Note: Your membership contribution to the Mary Flagler Cary Arboretum is eligible for the IBM Matching Grants Program for Hospitals and the Arts.

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